Miller, Anna

From: Duncan Hamilton <hamiltongeologicalservices@outlook.com>
Sent: Friday, March 17, 2017 11:40 AM
To: Miller, Anna
Subject: RE: Energex Injection Well Application Lanphar 1-12

Hi Anna:

Sorry we haven't been able to connect via phone. The one hour time difference isn't much but could be enough I guess to offset our schedules. I have some meetings this afternoon out of the office but will try to grab your call if I can. Please do not hesitate in sending me any questions or comments that I can address to your satisfaction. Energex is anxious to move forward with the project.

Best Regards

Duncan Hamilton, M.Sc., P.Geo
Chief Operating Officer
Energex Petroleum (USA) LLC
Cell: (226) 238-0296
Email: hamiltongeologicalservices@outlook.com

From: Miller, Anna [mailto:miller.anna@epa.gov]
Sent: March 16, 2017 3:42 PM
To: Duncan Hamilton <hamiltongeologicalservices@outlook.com>
Subject: RE: Energex Injection Well Application Lanphar 1-12

Duncan:
I've left you a voice message this afternoon. Please call me when you can; I would like to discuss the permit evaluation to date. We are nearly through the process, but must speak with you about some certain points.

Best regards,

Anna

Anna Miller
Environmental Scientist
Underground Injection Control Branch
U.S. EPA Region 5 (WU-16J)

77 W. Jackson
Chicago, IL 60604
(312) 886-7060

From: Duncan Hamilton [mailto:hamiltongeologicalservices@outlook.com]
Sent: Wednesday, February 08, 2017 7:59 AM
To: Miller, Anna <miller.anna@epa.gov>
Subject: RE: Energex Injection Well Application Lanphar 1-12

Hi Anna:

Was just wondering if any progress has been made on Energex's application for Lanphar 1-12.

Best Regards

Duncan Hamilton
COO
Energex Petroleum (USA) LLC

From: Miller, Anna [mailto:miller.anna@epa.gov]
Sent: October 25, 2016 2:34 PM
To: Duncan Hamilton <hamiltongeologicalservices@outlook.com>
Subject: RE: Energex Injection Well Application Lanphar 1-12

Hi Duncan –
I just completed a draft package which is in the supervisors inbox. I will let you know when we get to the next step.

Anna

Anna Miller
Environmental Scientist
Underground Injection Control Branch
U.S. EPA Region 5 (WU-16J)
77 W. Jackson
Chicago, IL 60604
(312) 886-7060

From: Duncan Hamilton [mailto:hamiltongeologicalservices@outlook.com]
Sent: Tuesday, October 25, 2016 11:30 AM
To: Miller, Anna <miller.anna@epa.gov>
Subject: Energex Injection Well Application Lanphar 1-12

Hi Anna:

It's been a while since we last communicated and was wondering if there has been any development on Energex's application for Lanphar 1-12.

Regards,

Duncan Hamilton, M.Sc., P.Geo
President
Hamilton Geological Services

Office:
533 George Street,
Port Stanley, ON, CAN, N5L 1H3
Cell: (226) 238-0296
Email: hamiltongeologicalservices@outlook.com

Conversation Record

Anna Miller, UIC Branch AM

Date: 3/20/17

Who: Duncan Hamilton, Energex AM

What: Maximum injection pressure for the proposed well Lanphar 1-12 MI-125-2R-0003

I discussed that EPA in Region 5 is modifying the way it calculates maximum injection pressure (MIP) for gas injection wells overall, because at least some fraction of the gas injected will be liquid at the pressures and temperatures of injection. Gas injected in the Lanphar 1-12 would fit this description. EPA's approach is a conservative assumption that uses th specific gravity of the heaviest component of the gas as a liquid. EPA's results are that MIP for the Lanphar 1-12 calculates as 1000 psig. I asked whether the well could function for its purpose at this injection MIP. I also asked about the source of the injected gas.

Duncan stated that the MIP would be workable for the purpose of this well, which reinjects gas from the production zone within the AoR. They are interested in keeping the formation pressure up for enhanced recovery.

PENNSTATE EARTH AND MINERAL SCIENCES ENERGY INSTITUTE COLLEGE OF EARTH AND MINERAL SCIENCES

CO_2 Calculator

—— A web computational tool ——

The Equation of State (EoS) by Span and Wagner (1996) is used to calculate the properties of pure CO_2 at the temperatures from -56.558-826 °C and pressures up to 8000 bar

Input options

- (•) *t*—*P*: for properties at a given *t*-*P*
- ( ) *t*: for properties at saturation conditions

P / bar	psi	1900
t / °C:	oF	100

Reset Calculate

Outputs

P_{sat} / bar	
$\rho_{CO2(sc)}$ / g cm^{-3}	0.76467849347724
$\rho_{CO2(l)}$ / g cm^{-3}	N/A
$\rho_{CO2(v)}$ / g cm^{-3}	N/A

Symbols

P	pressure, bar
P_{sat}	CO_2 saturation pressure, bar
t	temperature in C
ρCO2	density of CO2, g cm^{-3}
(l)	liquid phase
(v)	vapor phase
(sc)	supercritical phase

References

1. Span and Wagner (1996), A new equation of state for carbon dioxide covering the fluid region from the triple-point temperature to 1100K at pressures up to 800 MPa. *J. Phys. Chem. Ref. Data.*, **25**, 1509-1596.

*Haining Zhao created this web computational tool.
Updated: April 6, 2015

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

To: Well file, MI-125-2R-0003

From: Anna Miller, UIC Branch

Re: Maximum injection pressure calculation for the Lanphar 1-12 proposed injection well

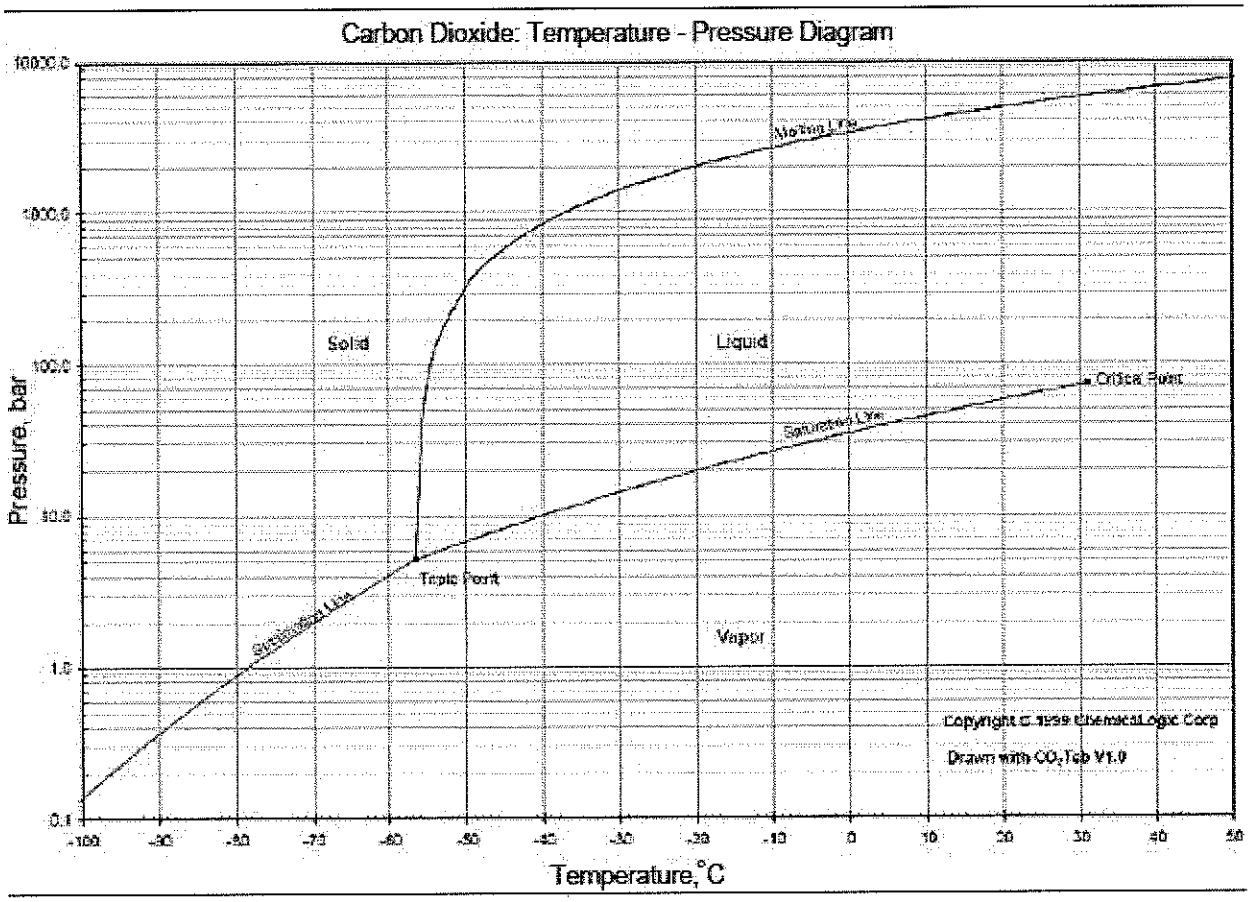
Date: 3/24/17

EPA Action
EPA received an application to permit a Class II UIC well for enhanced recovery for oil and gas production. The Lanphar 1-12 well is an already-constructed well which is proposed to be converted from a production well to an injection well for enhanced oil and gas recovery. EPA's action is to approve or deny a permit based on reviewing the existing construction and proposed operating conditions for suitability as an injection well.

Maximum injection pressure (MIP)
The applicant proposes to inject gas produced during oil extraction into the proposed well for enhanced recovery purposes. The gas mixture to be injected would most likely be in two phases – gas and liquid, at the conditions proposed and described in the application, i.e.,1400 psig estimated maximum injection pressure and 100° F. Therefore, the gas equation for MIP would not be appropriate. Therefore, EPA used the liquid MIP calculation:
MIP = [{«FractureGrad» *psi/ft* - (0.433 *psi/ft*)(specific gravity)} x depth] - 14.7 *psi*

For the calculation, EPA considered the density of gas constituent with greatest molecular weight, carbon dioxide. To evaluate the density of CO2 for injection, EPA used the CO2 density calculator developed by Penn State Earth and Mineral Science Energy institute and found at www.energy.psu.edu/tools/CO2-EOS. To calculate CO2 density, EPA use a conservative injection pressure of 1800 psi (for liquids, as pressure increases, density increases; per the liquid MIP calculation, as density increases, maximum injection pressure decreases).
CO2 density output from the Penn State CO2 density calculation tool and maximum injection calculations using the Region 5 SOP construction/MIP calculation spreadsheet are attached.
MIP = 1855 psig.

From: https://hub.globalccsinstitute.com/publications/co2-liquid-logistics-shipping-concept-llsc-overall-supply-chain-optimization/31



1000 psig = 69 bars

100° F = 38° C

CO_2 Calculator

—— A web computational tool ——

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Input options

- (•) *t*—*P*: for properties at a given *t*-*P*
- ( ) *t*: for properties at saturation conditions

P / bar: psi ▾ 1900

t / °C: oF ▾ 100

Reset | Calculate

Outputs

P_{sat} / bar	
$\rho_{CO2(sc)}$ / g cm^{-3}	0.764678493477724
$\rho_{CO2(l)}$ / g cm^{-3}	N/A
$\rho_{CO2(v)}$ / g cm^{-3}	N/A

Symbols

P	pressure, bar
P_{sat}	CO_2 saturation pressure, bar
t	temperature in C
ρ_{CO2}	density of CO_2, g cm^{-3}
(l)	liquid phase
(v)	vapor phase
(sc)	supercritical phase

References

1. Span and Wagner (1996), A new equation of state for carbon dioxide covering the fluid region from the triple-point temperature to 1100K at pressures up to 800 MPa, *J. Phys. Chem. Ref. Data.*, 25, 1509-1596.

*Haining Zhao created this web computational tool.
Updated: April 6, 2015

CALCULATION OF WELL-SPECIFIC PRESSURE EFFECTS

Facility Name		Operator	
Lanphar 1-12		Energex Petroleim Corp	
Well Name		USEPA Permit Number	State Permit Number
Lanphar 1-12		MI-125-2R-0030	
County	State	Well Class	Analyst
Oakland	Michigan	2R	A. Miller
Township	Range	Section	Date
5N	11E	12	20-Mar-17

JUSTIFICATION FOR FRACTURE GRADIENT

Administrative Basis for Fracture Gradient	Field Name
Code of Federal Regulatiions § 147.1152(b)	Default
Site-specific Testing Basis for Fracture Gradient	

Source of Fracture Gradient	Well Name	Test Date	Fracture Gradient
default			**0.80**

MAXIMUM INJECTION PRESSURE

PRESSURE LOSS TO FRICTION

Fracture gradient, psi/ft	Type of Fluid, liquid or gas	Maximum Injection Rate, gpm	Viscosity of injectate, cp.
0.80	liquid	0	0.0
Top of Inj. Zone, ft		Diameter of the Tubing, in.	Average velocity of injection, ft/sec
3988	100	0.000	
Specific Gravity		Weight of Tubing, lbs/ft	Reynolds Number
0.765		0.000	
	Maximum Injection Pressure, psi	Internal Diameter of Tubing, ins	Total Friction Loss, psi
	1855	0.000	

INFORMATION FOR CALCULATING PRESSURE CHANGE

Total Volume of Well (tubing and Open Hole), gals	Total Volume of Annulus, gals
255	4047
Predicted Well Bore Storage, gals/psi	Additional Volume to Increase Pressure by 100 psi, gals
0.007	0.12